1995 AIR QUALITY DATA SUMMARY

CITY OF NANTICOKE

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West Central Region
Ontario Ministry of Environment and Energy

In cooperation with:

Stelco Inc.
Inperial Oil
Ontario Hydro
and
Environment Canada

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SUMMARY

Air monitoring in the industrial area of the City of Nanticoke showed that air quality was generally very good to excellent. Pollutants such as sulphur dioxide, nitrogen oxides, particulates and fluoride showed low concentrations, below Ministry objectives. Three types of pollutants were measured at higher levels. These were:

1/ Sulphur odours near Stelco Steel in Nanticoke Village. These were the result primarily of slag quenching operations and coke oven related operations at Stelco. The company instituted operational changes at its blast furnace facility in 1995 and concentrations improved correspondingly, following a record year in 1994. The blast furnace slag pit was also lengthened again in 1996 which may result in further improvements.

2/ Organic semi-volatile hydrocarbons known as polycyclic aromatic hydrocarbons near Stelco in Nanticoke Village were elevated and sometimes above the daily objective of the one compound with a guideline - benzo(a)pyrene. However, concentrations were almost 50% lower than in 1994. Similarly, benzene levels in Nanticoke Village were reduced by about 50% since 1993. The improvements were likely due to the installation of an odour control system at the Stelco coke oven plant.

3/ Ground level ozone concentrations arising from long range transport of precursor pollutants from the United States during the summer. These levels occur across Southern Ontario. Ozone is damaging both to agricultural crops and human health. To solve this problem, control programs are being implemented in both the U.S. and Canada to reduce industrial and automotive emissions. The programs have set a target year of 2005 by which time the ozone guidelines should be met.

The other two major industries in the area, Imperial Oil and Ontario Hydro's Nanticoke Generating Station showed mostly negligible ground level effects. Imperial Oil's only effect appeared to be localized sulphur odour emissions, while Ontario Hydro's main emissions - sulphur dioxide and oxides of nitrogen, met all objectives out of over 60,000 monitoring hours.

INTRODUCTION

The Nanticoke Environmental Management Program (NEMP) was formed in 1978 to co-ordinate a study of the background air quality and subsequent impact of industrial development on air quality in the area surrounding Nanticoke. NEMP was sponsored jointly by the Federal and Ontario Governments, Ontario Hydro, Stelco and Texaco (now Imperial Oil). Beginning in 1984, the West Central Region of the Ontario Ministry of Environment and Energy assumed responsibility for network operations from the Air Resources Branch at MOE.

In mid - 1985, NEMP and a similar group concerned with water quality were amalgamated into one organization called the Nanticoke Environmental Committee (NEC). A private contractor funded by Imperial Oil and Stelco provided one technician to assist in maintaining the air monitoring network. As of 1992, NEC concentrated solely on air quality and the air monitoring network. Water discharge issues are addressed by the MISA program of the MOEE, with each company meeting industry specific requirements.

The Nanticoke Environmental Committee consists of environmental personnel from the three industries and representatives from the MOEE West Central Region and Environment Canada. The committee meets approximately six times per year and holds an annual public meeting in November.

The purpose of the air monitoring program is to determine compliance with provincial air quality criteria and also to measure the impact of the industrial development on the local air quality. Contaminants which may enter the area from outside sources are also identified.

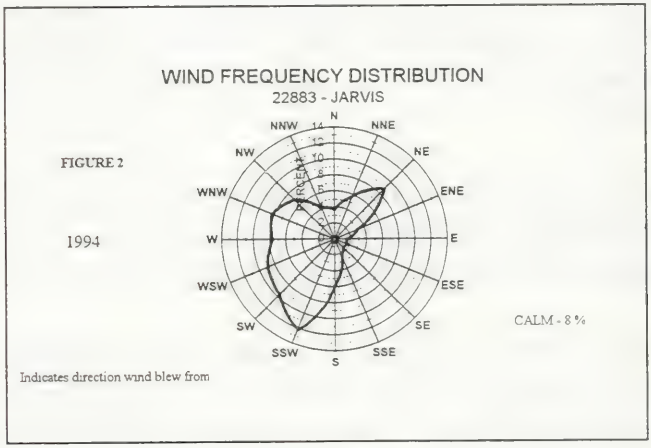
The three main industries which have located in Nanticoke are Ontario Hydro's Thermal Generating Station, Imperial Oil's oil refinery and Stelco's basic steel plant. In addition, several smaller industries have located in the Stelco Industrial Park, north of Stelco.

NEC has undertaken to measure the ambient air concentrations of those compounds or substances that are regulated under the Provincial and Federal Environmental Protection Acts, and that could be a result of the Nanticoke industrial activities. The air quality criteria are set for the protection of human health and well being as well as to protect vegetation, animal life and property.

MONITORING NETWORK

Monitoring stations have been located to take into account predominant wind patterns and source locations as well as to try to differentiate between industrial and other contributions.

A map of the 1995 network is shown in Figure 1a with a closeup in Figure 1b, and the pollutants measured at each location are given in Table 1. Wind data (speed and direction) were measured at Long Point, near Jarvis and in Nanticoke Village. Figure 2 displays the wind frequency distribution measured at Jarvis. Winds from the west, southwest, and northeast sectors tend to predominate.



In addition to the NEC monitoring network, Ontario Hydro has operated its own network of sulphur dioxide analyzers since 1970. These data are also referred to in this report.

Some of the monitoring equipment in the network has also been provided by Environment Canada under the National Air Pollution Surveillance (NAPS) program. The instruments are operated and maintained by NEC and data are forwarded to Environment Canada.

TABLE 1
MONITORING NETWORK

MAP REF	STATION NUMBER	LOCATION	SO2	TSP	COH	TRS	O3	NOx	DF	F	VOC	PAH	WIND	TEMP
1	22070	Nanticoke Village							X	X				
2	22071	Simcoe	X				X	X			X	X		
3	22074	Imperial Oil								X				
4	22083	Dogs Nest								X				
5	22086	Cheapside	X					X						
6	22092	Rainham/Sandusk		X					X					
7	22093	NGS Flyash area							X					
8	22094	Townsend	X											
9	22901	Long Point	X				X	X					X	X
10	22904	S Walpole School	X(OH)	X		X					X			
11	22907	Nanticoke Village	X	X	X	X					X	X	X	
12	22961	Nanticoke North								X				
13	22964	Stelco North		X										
14	22883	Jarvis											X	X
15	22911	Balmoral	X(OH)											
16	22913	Nanticoke Rd	X(OH)											

SO2 -Sulphur Dioxide
TSP - Total Suspended Partic
COH - Soiling Index
TRS - Total Reduced Sulphur
O3 - Ozone
NOx - Nitrogen Oxides
DF - Dustfall
F - Fluoride
VOC - Volatile Organic Compounds
PAH- Polycyclic Aromatic Hydrocarbons
OH - Ont Hydro

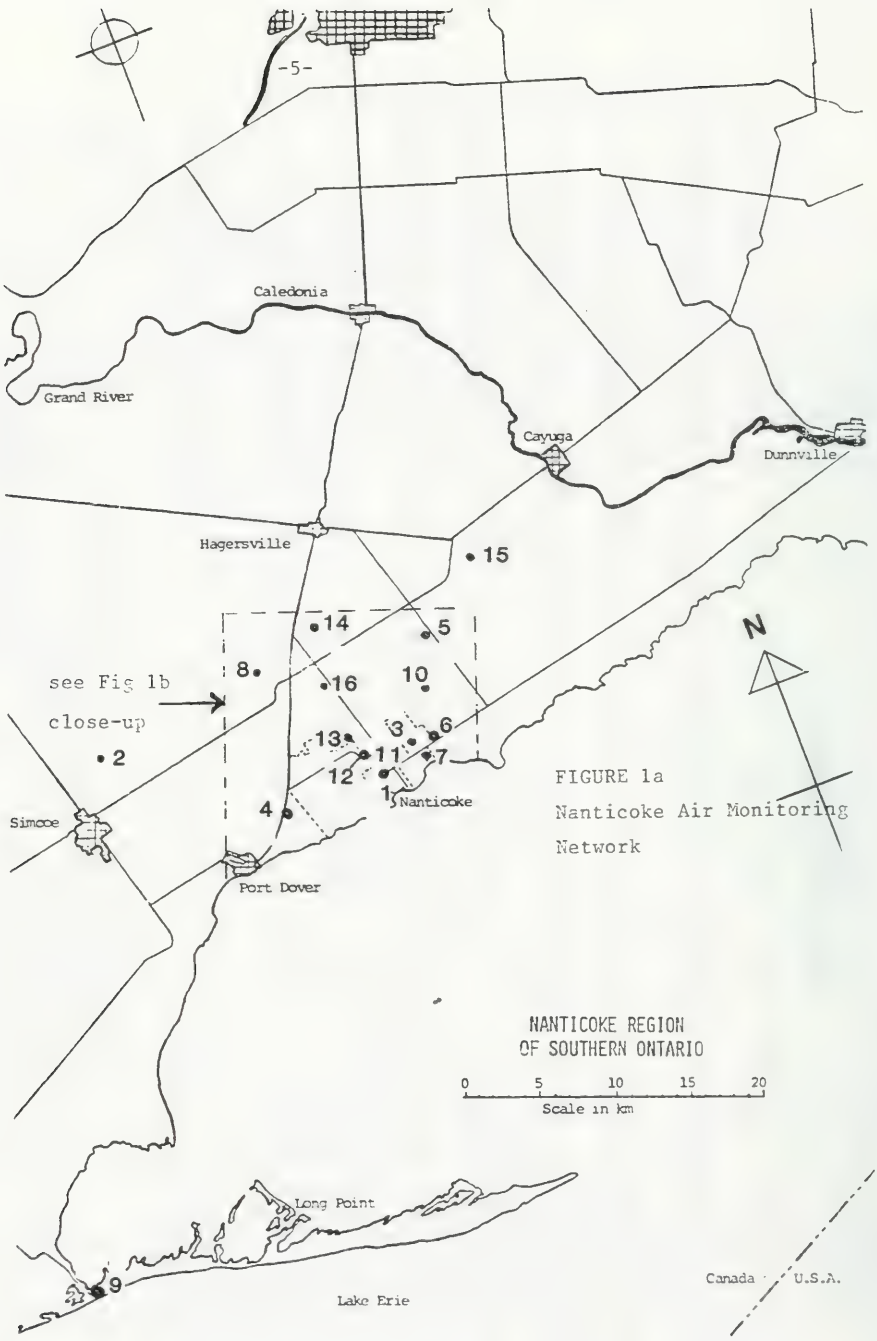


FIGURE 1a
Nanticoke Air Monitoring
Network

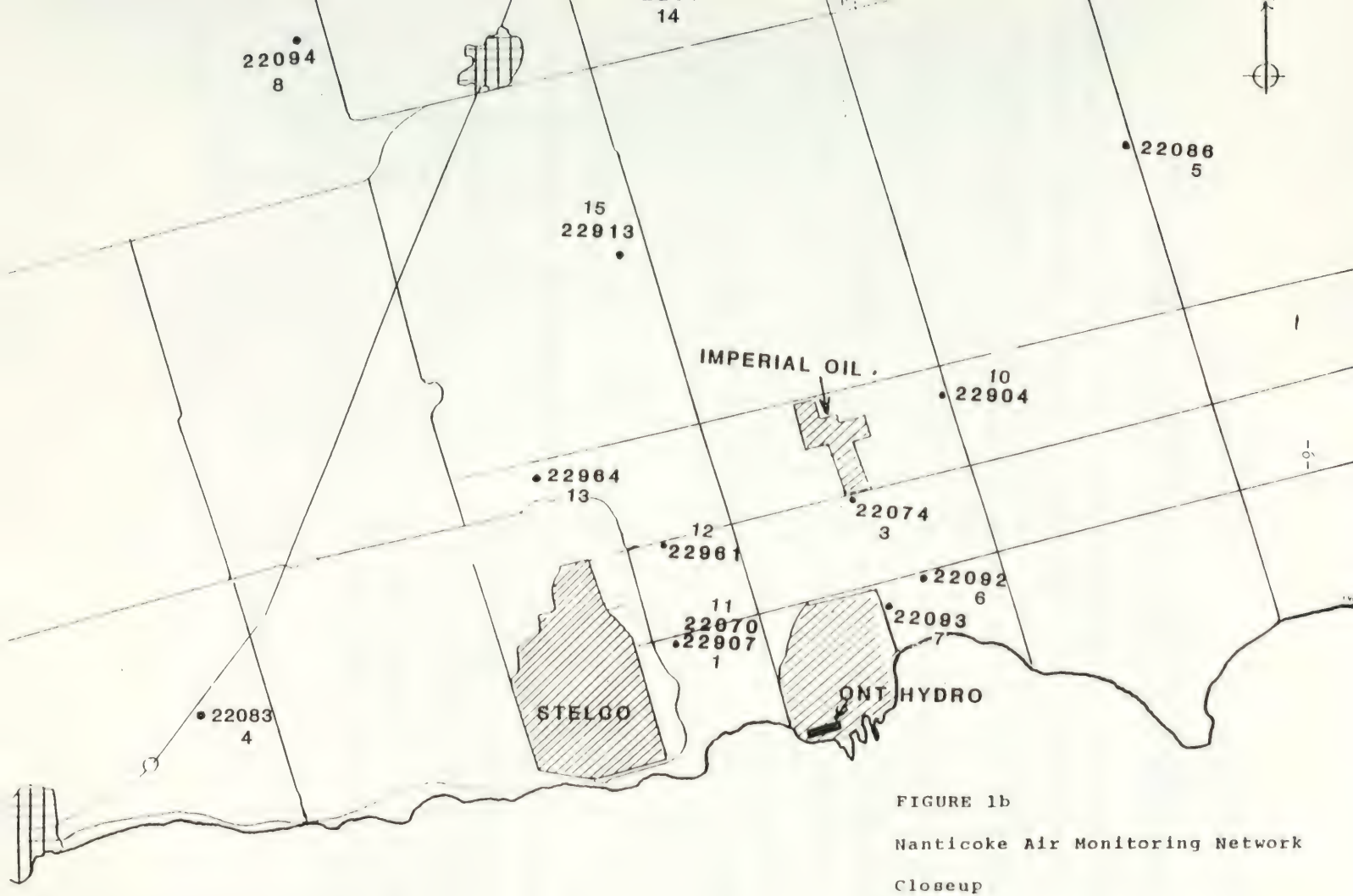


FIGURE 1b

Nanticoke Air Monitoring Network

Closeup

ANALYSIS OF DATA

Sulphur Dioxide

Sulphur dioxide (SO_2) was measured continuously at five sites within the NEC network and at three Ontario Hydro stations in 1995. Monitoring data at all of the stations was well within the annual and daily air quality objectives of .02 and .10 ppm respectively and, the hourly standard of .25 ppm was not exceeded at any station out of about 60,000 hours of monitoring. Data are given in Table 2.

Figure 3 illustrates the historical trend of sulphur dioxide annual average concentrations of four SO_2 monitors which have operated continuously since 1976. A modest decline in concentrations can be seen over this period.

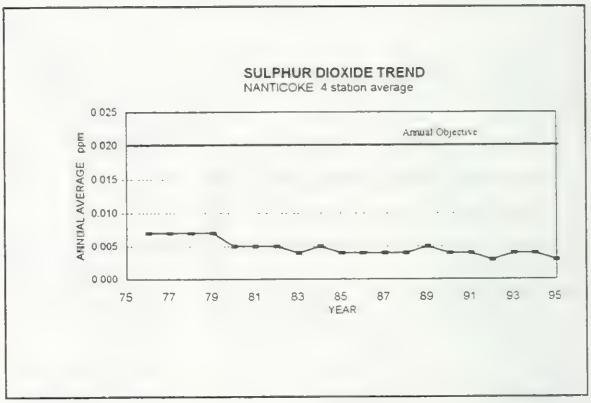


FIGURE 3

Similarly in Figure 4, the number of hourly exceedences per year at these stations is shown. A declining trend is apparent in this graph as well. There have been no exceedances of the hourly criterion since 1989 at any station.

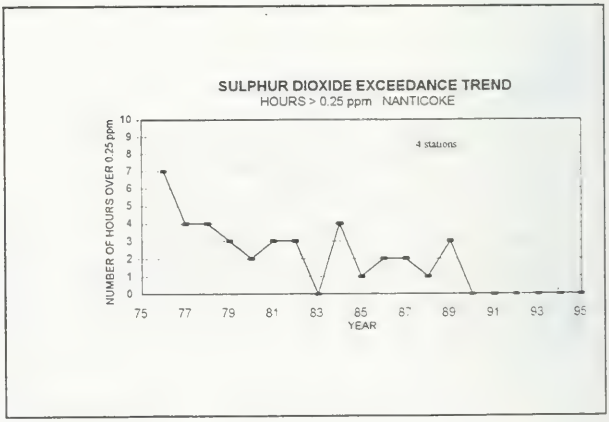


FIGURE 4

TABLE 2
SULPHUR DIOXIDE

parts per million

YEAR	ANNUAL AVERAGE	MAXIMUM		No. Times > Objective	
		1 HR	24 HR	1 hr	24 hr
22071 - Simcoe					
1995	0.002	0.11	0.01	0	0
1994	0.002	0.05	0.03	0	0
1993	0.003	0.09	0.03	0	0
1992	0.003	0.06	0.03	0	0
22086 - Cheapside					
1995	0.003	0.11	0.02	0	0
1994	0.005	0.13	0.03	0	0
1993	0.004	0.08	0.02	0	0
1992	0.005	0.14	0.03	0	0
22094 - Townsend					
1995	0.003	0.08	0.02	0	0
1994	0.003	0.10	0.02	0	0
1993	0.004	0.08	0.02	0	0
1992	0.003	0.07	0.03	0	0
22901 - Long Point					
1995	0.002	0.04	0.01	0	0
1994	0.003	0.06	0.02	0	0
1993	0.002	0.15	0.03	0	0
1992	0.005	0.06	0.03	0	0
22907 - Nanticoke Village					
1995	0.004	0.17	0.03	0	0
1994	0.006	0.19	0.04	0	0
1993	0.005	0.11	0.03	0	0
1992	0.004	0.10	0.04	0	0
22911 - Balmoral(NNE16) Ontario Hydro monitor					
1995	0.002	0.09	0.02	0	0
1994	0.003	0.12	0.02	0	0
1993	0.003	0.08	0.02	0	0
1992	0.003	0.07	0.03	0	0
22913 - Nanticoke Rd(NNW08) Ontario Hydro monitor					
1995	0.002	0.18	0.02	0	0
1994	0.003	0.07	0.02	0	0
1993	0.003	0.14	0.02	0	0
1992	0.002	0.13	0.03	0	0
22916 - Walpole School S (NNE05) Ontario Hydro monitor					
1995	0.003	0.06	0.01	0	0
1994	0.004	0.13	0.02	0	0
1993	0.004	0.10	0.02	0	0
1992	0.004	0.13	0.03	0	0

Ontario Objectives: .25 ppm (1 hour)
.10 ppm (24 hour)
.02 ppm (annual)

Total Reduced Sulphur

Total Reduced Sulphur (TRS) was monitored at two locations - in Nanticoke Village and at South Walpole School on Sandusk Road. There are no general criteria for TRS but there is an hourly objective for hydrogen sulphide (H_2S), the "rotten egg" gas, of 20 ppb. The monitoring instrument measures H_2S, and other sulphur compounds.

Possible sources of these pollutants include slag quenching activities and the coke ovens/by-products plant at Stelco and fuel oil storage tanks and a sulphur recovery operation at Imperial Oil. Apart from industrial sources, sulphur compounds can be liberated from groundwaters that have been contaminated by natural seepages or from leaking natural gas wells, known to exist in the area. Stelco sulphide emissions have been shown to consist primarily of H_2S and thus, comparison of TRS data to the H_2S objective, particularly within Nanticoke Village when downwind of Stelco, is reasonable. Imperial Oil emissions have been less well characterized but are not believed to consist totally of H_2S. Other organic sulphur compounds are probably present in their emissions and consequently levels downwind of this refinery cannot always be compared to the H_2S standard. The TRS data are summarized in Table 3 and trends are illustrated in Figure 5.

FIGURE 5

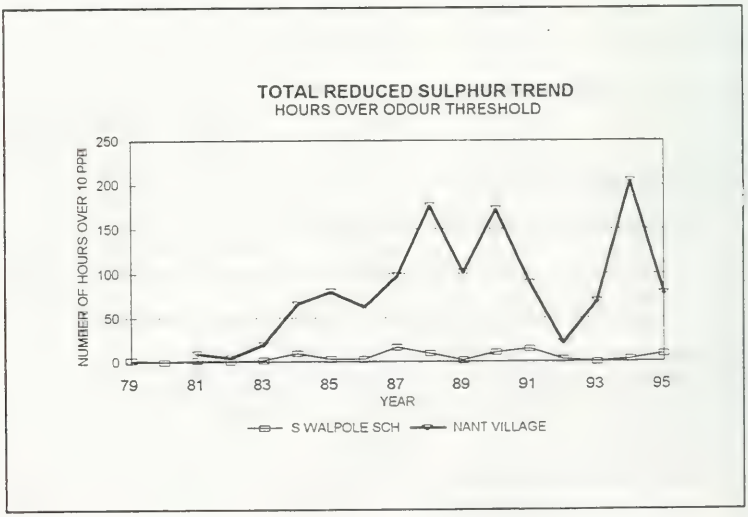


TABLE 3
TOTAL REDUCED SULPHUR

parts per billion

YEAR	ANNUAL AVERAGE	MAXIMUM 1 HR	No. hours above	
			20 ppb	10 ppb
22904 - South Walpole School				
1995	0.6	17	0	9
1994	0.6	26	1	3
1993	0.4	10	0	0
1992	0.5	17	0	3
22907 - Nanticoke Village				
1995	1.1	65	23	88
1994	1.6	55	34	204
1993	1.1	28	2	69
1992	1.0	20	0	22

Ontario Objective: 20 ppb (1 hour) - Hydrogen Sulphide

The South Walpole School station did not exceed the criterion level of 20 ppb, but exceeded the odour threshold of 10 ppb during nine hours in 1995, as given in Table 3, slightly more than in the previous few years. Six of these events co-incided with higher levels measured in Nanticoke Village, implying that Stelco was the source. The three other hours were not accompanied by elevated levels in the Village, and as winds were from the southwest, Imperial Oil may have been the source of those.

Levels recorded in Nanticoke Village close to Stelco improved in 1995. There were 23 hours above the hourly H_2S objective (20 ppb) during the year and 88 hours above the odour threshold level of 10 ppb. This follows the 1994 results, which recorded 204 hours over 10 ppb, the most ever for this site. The improvement was due to two changes at Stelco. Firstly, the blast furnace slag quench pit was lengthened, which increased the surface area of molten slag, promoting greater air cooling. Secondly, the company modified water quenching cycles at the slag pits, again promoting greater air cooling and thus reducing emissions.

The other main odour sources at Stelco - the coke oven plant, has also been addressed. A new gas collection system for the tar decanters and dehydrators was installed across the entire coke oven plant in 1994. The effectiveness of this system is still being studied, but improvements in hydrocarbon levels were observed in 1995 (to be discussed in subsequent sections).

Oxides of Nitrogen

Oxides of nitrogen result from high temperature combustion sources including automobiles and industrial facilities. The most abundant oxides are nitric oxide (NO) which is largely a direct emission of fuel burning and nitrogen dioxide (NO_2) which is mostly an oxidation product once the contaminant is airborne. Thus, in the plume from the Ontario Hydro stacks, colourless NO is emitted and, as it oxidizes to brown coloured NO_2 in the atmosphere, a yellowish brown colour can appear. It had been hoped that the installation of low NO_x burners, as part of the acid rain program would remove this, but some coloration still occasionally appears. Imperial Oil boilers and various sources at Stelco are also emitters of these pollutants.

Objectives exist only for nitrogen dioxide and are based on odour threshold levels (hourly - .2 ppm) and health effects (24-hour - .1 ppm). Other adverse effects occurring at higher levels include vegetation damage, reduced visibility and corrosion of metals.

Data for NO_2 for three stations are summarized in Table 4. Levels in 1995 continued to be very low and well within objectives. There have never been any NO_2 exceedences measured.A combined yearly trend of NO_2 for the stations is given in Figure 6. Overall, a small trend to decreasing concentrations is apparent.

FIGURE 6

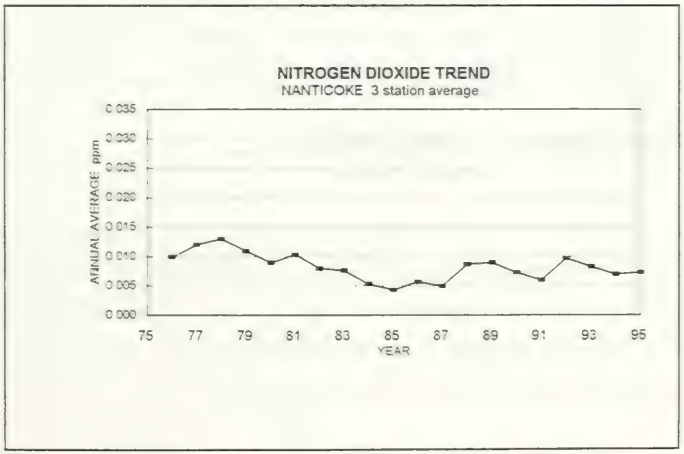


TABLE 4
NITROGEN DIOXIDE

parts per million

YEAR	ANNUAL AVERAGE	MAXIMUM		No. Times > Objective	
		1 HR	24 HR	1 hr	24 hr
22071 - Simcoe					
1995	0.008	0.05	0.02	0	0
1994	0.004	0.04	0.02	0	0
1993	0.008	0.08	0.04	0	0
1992	0.010	0.05	0.03	0	0
22086 - Cheapside					
1995	0.007	0.05	0.03	0	0
1994	0.010	0.11	0.04	0	0
1993	0.012	0.06	0.03	0	0
1992	0.013	0.05	0.03	0	0
22901 - Long Point					
1995	0.007	0.07	0.04	0	0
1993	0.005	0.12	0.03	0	0
1992	0.006	0.05	0.03	0	0
1991	0.006	0.08	0.02	0	0

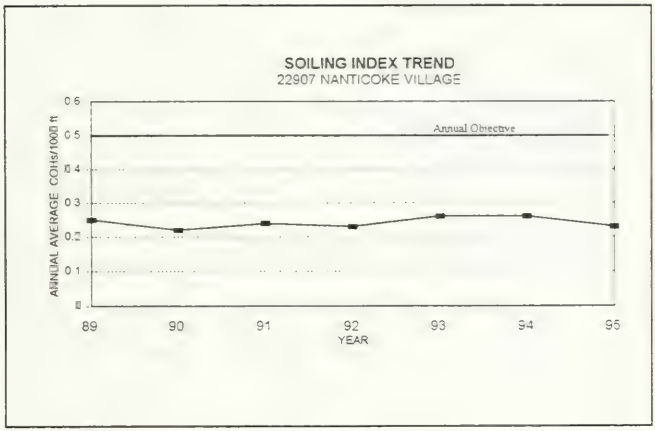
Ontario Objectives : .20 ppm (1 hour)
.10 ppm (24 hour)

Soiling Index (Coefficient of Haze)

Coefficient of haze tape samplers operate continuously and determine hourly soiling values of dust in air. Air is drawn through a filter paper trapping dust on the filter, and the optical density of the darkened spot is measured by light transmittance. The instrument takes readings before and after sample collection. The resultant light obstruction is determined and converted to a unit known as coefficient of haze. The particles sampled are very small, less than 10 microns in diameter (a micron is a millionth of a metre) and thus represent the respirable range.

One tape sampler operates at 22907 - Nanticoke Village and the 1995 data are summarized in Table 5. The yearly average was half the yearly objective and the daily objective was not exceeded. Concentrations over seven years of sampling have been stable as shown by Figure 7.

FIGURE 7



Despite these favourable results, black dust fallout complaints arose in 1995. A special continuous particulate sampler measuring fine particles by their mass rather than light transmission was temporarily installed in 1996. It has proven to be a better device to monitor dust than the COH sampler. The COH appears less able to sample particles during stronger wind speeds, which are more common in the Nanticoke area. Stelco is investigating this issue to determine if any of its operations are the source of the black fallout.

TABLE 5
SOILING INDEX

COHs per 1000 ft

YEAR	ANNUAL AVERAGE	MAXIMUM 24 HR	No of days over 24 hour Objective
22907 - Nanticoke Village			
1995	0.23	0.8	0
1994	0.26	0.8	0
1993	0.26	0.8	0
1992	0.23	0.7	0
1991	0.24	0.7	0

Ontario Objectives: 1.0 COHs/1000 ft (24 hour)

0.50 COHs/1000 ft (1 year)

Ozone

Oxidants are products of photochemical reactions involving oxides of nitrogen, hydrocarbons and sunlight. The nitrogen oxides and hydrocarbons come mainly from cars and industry. Ozone (O_3) is the main oxidant chemical produced. At high altitudes, the ozone layer filters harmful ultra-violet radiation from incoming sunlight, but at ground level, it is an unwelcome pollutant. Ozone damages vegetation including tobacco and tomato crops. The 1-hour objective for ozone (.08 ppm) is based on vegetation effects, but ozone is also a respiratory irritant and can have adverse human health effects.

Ground level ozone concentrations follow very definite annual and daily trends. Highest levels occur during the summer (May to September), and the daily maxima usually occur during mid-afternoon. Both patterns occur because ozone production increases with temperature and sunlight.

Ozone concentrations were measured at two sites and data are summarized in Table 6. In 1995, ozone levels again frequently exceeded the hourly objective in the summer as in previous years. There were 128 exceedances of the objective observed at Long Point and 119 at Simcoe. Elevated levels generally occurred at the same time at both stations during the summer with slightly higher concentrations measured at Long Point during southerly winds indicating that the high concentrations were imported from the United States.

The yearly trend graph of hourly exceedences at the two stations in Figure 8 indicates random fluctuations which are probably related to climatological variation. A number of measures are being taken to reduce ground level ozone, discussed below.

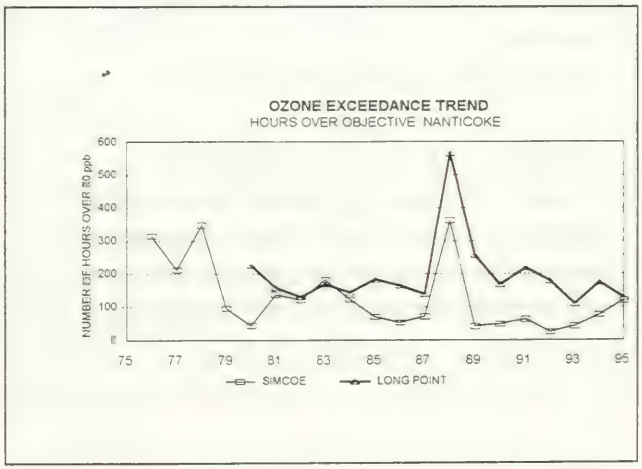


FIGURE 8

A hopeful sign that these measures are having a positive effect is that the summer of 1995 was about the equivalent, weatherwise, of 1988 when very high ozone levels were measured; ie very hot and

sunny. But the peak measured in 1988 did not reappear in 1995.

Ozone, hydrocarbons and oxides of nitrogen can be transported over great distances and can be augmented by local sources. It is generally believed that the ozone problem in Southern Ontario has a large component due to long range transport from the United States and thus will have to be resolved on an international and national rather than local scale.

In recognition of the seriousness of the ground-level ozone problem, the Canadian Council of Ministers of the Environment decided in 1988 to develop a management plan for the control of nitrogen oxides (NOx) and volatile organic compounds (VOC). A three phase NOx and VOC control plan was developed to resolve the ozone problem by the year 2005. This program is being undertaken in concert with the United States which plans similar strategies.

The Ministry is taking its own initiatives in combatting photochemical smog. To reduce NOx and VOC, the precursors of ozone, a number of new regulations are being introduced including:

-The requirement for gasoline companies and service stations to install vapour recovery equipment on fuel tanks and trucks (by 1996).
-NOx emissions from stationary turbines must be reduced from 200 ppm to 25 ppm.
-Refineries must produce gasolines which are less volatile during the summer.
-Dry cleaners will be required to undergo education programs by 1996 to minimise their VOC emissions
-Ontario Hydro has already reduced their NOx emissions by 37 kilotonnes in the past 2 years.

Further, as an interim measure, the Ministry, in co-operation with Environment Canada, broadcasts air quality advisories for Southern Ontario related to the ozone monitoring program. When ozone levels are expected to reach 80 ppb or higher the next day, such a forecast will be included in normal weather reports. The public is advised to avoid strenuous exercise, and that sensitive individuals may experience respiratory symptoms and should alter their activities accordingly. The public is encouraged to reduce their use of automobiles, to car pool, to use public transit and to avoid the use of solvents, oil based paints and gasoline powered equipment such as lawn mowers.

Locally, Ontario Hydro has already taken voluntary control steps by installing low - NO_x burners at its coal burning power plants, including Nanticoke. Imperial Oil voluntarily implemented a leak detection and repair program, aimed at reducing VOC emissions.

TABLE 6
OZONE

parts per million

YEAR	ANNUAL AVERAGE	MAXIMUM 1 HR	No. of Hours Over Objective
22071 - Simcoe			
1995	0.031	0.118	119
1994	0.030	0.103	77
1993	0.028	0.097	42
1992	0.026	0.106	25
22901 - Long Point			
1995	0.031	0.121	128
1994	0.032	0.158	174
1993	0.031	0.131	110
1992	0.032	0.133	179

Ontario Objective: .08 ppm(1 hour)

Total Suspended Particulates

Total suspended particulates (TSP) in air are measured with high volume samplers which draw a known volume of air through a pre-weighed filter for a 24 hour period (midnight to midnight). The exposed filter is weighed, and the difference (weight of solids on filter) in conjunction with the known air volume sampled is used to calculate a TSP concentration in micrograms per cubic meter. The objective for a 24 hour average is 120 ug/m^3 while the yearly geometric mean objective is 60 ug/m^3. The samplers operate once every six days.

Data from total suspended particulate measurements at four locations are summarized in Table 7. The yearly objective of 60 ug/m^3 was not exceeded at any of the stations, but the daily objective of 120 ug/m^3 was exceeded three times at 22907-Nanticoke Village and once at 22964 -Stelco North. There had been no exceedances in 1994. The three Village exceedances occurred during southwest winds, suggesting that Stelco was the likely source. The Stelco North exceedance occurred during northeast winds. Agricultural sources such as plowing activity likely caused this.

A total of four hi-vol stations have been operating continuously since 1984 in the Nanticoke area, and the combined yearly trend of these stations is shown in Figure 9. Although levels have been low, a gradual increase is evident in recent years. This coincides with the black dust fallout problem which emerged in 1995.

FIGURE 9

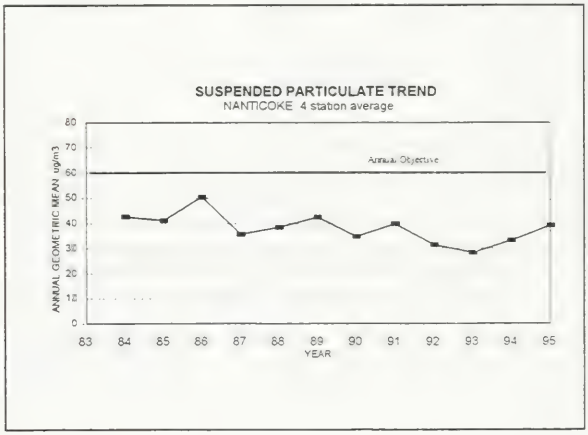


Figure 10 shows the trend of suspended particulate at station 22907 in Nanticoke Village near Stelco. Concentrations can been seen to be gradually increasing, similar to the overall network trend. Stelco and the Ministry are attempting to determine the source of the increased emissions.

FIGURE 10

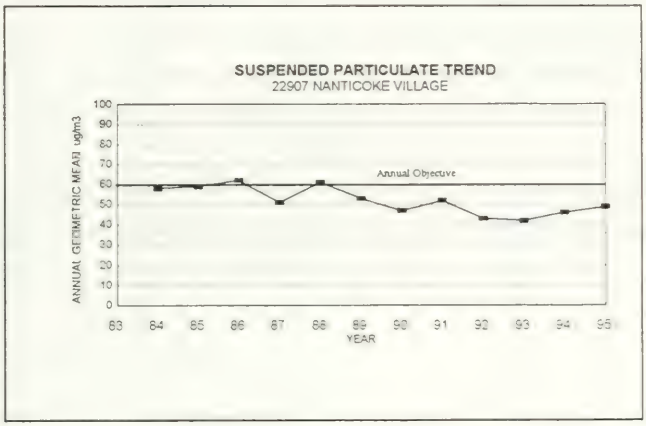


Figure 11 shows the trend of suspended particulate and dustfall at station 22092 near Ontario Hydro. A control program at their ash lagoon area introduced years ago and maintained to the present has resulted in acceptable particulate levels near this facility, generally well below objectives. Ontario Hydro has also converted to a dry ash system which has enabled them to sell most of their ash. This has further reduced the dust emission potential of the ash lagoon area.

FIGURE 11

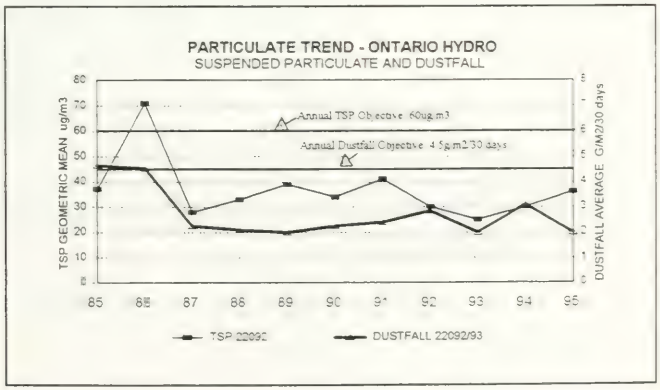


Table 7 refers to inhalable particulate measurements at 22904 - Walpole School. Inhalable particulate is defined as particles less than 10 microns in diameter. A micron is one millionth of a metre. These particles can penetrate into the human respiratory system, and research has shown a correlation of health effects and concentrations of these particles which are commonly referred to as PM10.

The measurement methodology is similar to that for suspended particulate, except the standard hivol sampler is outfitted with a size fractioning head, which permits sampling only of particles less than 10 microns. A standard for this measurement is currently being formulated.

The concentrations at Walpole School have been low and constant since monitoring began in 1992 and comprise about 35% of total suspended particles. These levels are much less than measured in urban areas.

TABLE 7
SUSPENDED PARTICULATES (TSP)

micrograms per cubic metre

YEAR	GEOMETRIC MEAN	MAXIMUM 24 HR	% OF SAMPLES OVER DAILY OBJECTIVE
22092 - Rainham/Sandusk			
1995	36	101	0
1994	30	78	0
1993	25	130	2
1992	30	110	0
22904 - South Walpole School			
1995	39	91	0
1994	29	62	0
1993	20	68	0
1992	26	82	0
22907 - Nanticoke Village			
1995	51	161	6
1994	48	113	0
1993	42	140	2
1992	43	137	3
22964 - Stelco North			
1995	34	121	2
1994	28	81	0
1993	27	80	0
1992	27	121	2
INHALABLE PARTICULATES (PM10)			
22304 - South Walpole School			
1995	14	43	
1994	15	41	
1993	15	69	
1992	15	60	

Ontario Objectives (TSP): 120 (24 hour)
60 (annual geo. mean)

Ontario Objectives (PM10): None

Dustfall

Dustfall is that material which settles out of the atmosphere by gravity. It is collected in plastic containers during a 30 day exposure time. The collected material is weighed and expressed as a deposition rate of grams/m^2/30 days. The measurement is imprecise and effects are restricted to relatively local areas, however, it is the best method for measuring this heavy material. Dustfall objectives are based on nuisance effects and are 7.0 grams/m^2/30 days (monthly) and 4.5 grams/m^2/30 days (yearly average). Since dustfall is comprised solely of non-inhalable large particles it is not a health related parameter.

Dustfall was measured within Nanticoke Village in 1995, (station 22070) and data are given in Table 8. As in previous years, concentrations were low but the monthly objective was exceeded once by a large margin in March.

The annual trend at this station since 1975 is given in Figure 12. An increase occurred in 1984, but concentrations decreased again in 1993-94, to well below the yearly objective. The increase observed in 1995 is due essentially to the one high March reading. Thus, this sampler did not measure the increase in black fallout as well as the suspended particulate sampler.

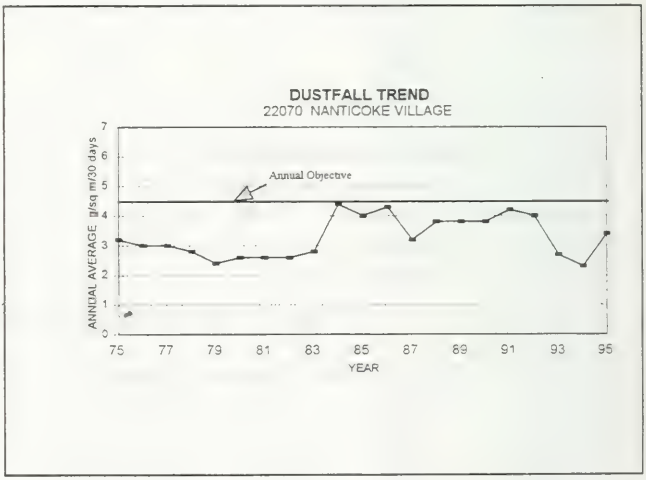


FIGURE 12

Two dustfall jars were located near the Ontario Hydro flyash lagoon area. The monthly objective was not exceeded at 22093 which lies closest to the ash lagoon area, or at station 22092.

The control program at Ontario Hydro referred to earlier has been successful in reducing windblown flyash emissions, previously shown by the trend graph in Figure 11.

TABLE 8
DUSTFALL

grams per square metre per 30 days

YEAR	ANNUAL AVERAGE	MAXIMUM 1 MO.	NO. OF MONTHS OVER OBJECTIVE
22092 - Rainham/Sandusk			
1995	1.9	4.3	0
1994	3.2	6.9	0
1993	2.4	8.2	1
1992	2.5	4.8	0
22093 - NGS Flyash Area			
1995	2.1	4.4	0
1994	3.0	6.6	0
1993	1.6	3.7	0
1992	3.2	6.7	0
22907 - Nanticoke Village			
1995	3.4	23.0	1
1994	2.3	5.9	0
1993	2.7	5.7	0
1992	4.0	4.9	0

Ontario Objectives : 7.0 (1 month)
4.5 (annual mean)

Fluoridation

This measurement is a relatively simple assessment used to determine quantities of fluoride compounds in the ambient air. A lime coated paper is exposed to the atmosphere for approximately 30 days and chemically analyzed for fluoride. The fluoride objectives are based on vegetation damage and for this reason, the objective is more stringent during the growing season. For the months of April to October, it is 40 micrograms/100 cm^2/30 days while for the remainder of the year it is 80. A possible source of this contaminant is Stelco's basic oxygen furnace, although gas scrubbing removes most of the emissions.

Four stations surrounding Stelco property monitored fluoride and 1995 data are given in Table 9 together with a trend graph in Figure 13. The fluoride objectives were exceeded four times within Nanticoke Village (22070). This monitor was relocated in 1994 from an old established site about 500 metres south and this resulted in higher readings since the Village site is more frequently downwind of the main steel mill sources. The observed levels are not cause for alarm, but trends will be monitored. The increase noted in the graph for 1994/95 is due mainly to the station relocation, ie. the readings would have been similar in previous years if measured at the new site.

FIGURE 13

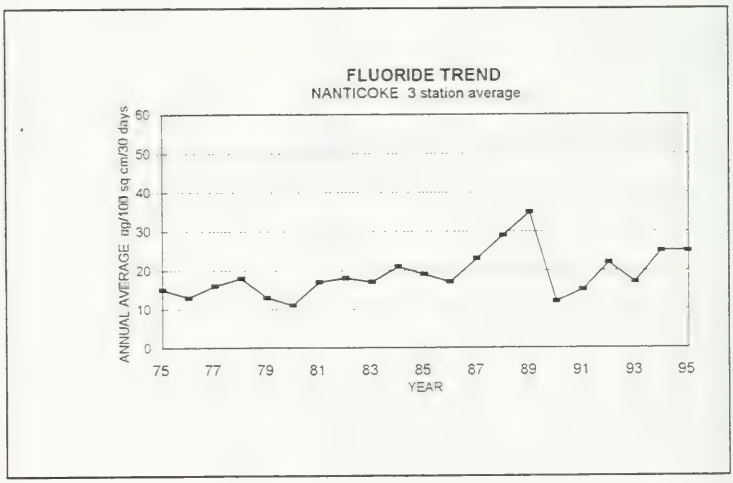


TABLE 9
FLUORIDATION RATE

micrograms / 100 square cm / 30 days

YEAR	ANNUAL AVERAGE	MAXIMUM 1 MO.	NO. OF MONTHS OVER OBJECTIVE
22057/70 - Nanticoke Village			
1995	44	62	4
1994	45*	106	3
1993	21	59	0
1992	25	51	2
22074 - Imperial Oil			
1995	17	25	0
1994	18	25	0
1993	16	42	0
1992	23	44	0
22083 - Dogs Nest			
1995	13	31	0
1994	13	22	0
1993	13	34	0
1992	18	32	0
22961 - Nanticoke North			
1995	22	35	0
1994	31	42	1
1993	27	39	0
1992	41	105	4

Ontario Objectives: 40 ug/100cm2/30 d (1 month) : Apr-Oct
80 ug/100cm2/30 d (1 month) : Nov-Mar

** 22057 moved to 22070 in March 1994*

Volatile Organic Compounds (VOC)

Airborne organic chemicals are of concern due to their complexity and variety of potential toxic effects, including carcinogenicity. Routine monitoring of these compounds in Nanticoke was undertaken at three locations.

The monitoring involves drawing a measured volume of air into glass cartridges containing an adsorbent material. Samples were run for 24 hours (midnight to midnight) every 12th day followed by analysis by gas chromatography for 32 chemicals at the MOEE laboratory. One site at Simcoe, was run by Environment Canada techniques, whereby 24 hour samples were collected in evacuated cannisters every 6th day and analyzed for 151 chemicals.

The three sites were chosen on the following basis: 22907 Nanticoke to be downwind of Stelco; 22904 - South Walpole School to be downwind of Imperial Oil; and 22071 - Simcoe to act as a background control location. Ontario Hydro is not considered to be a significant source of these contaminants.

Table 10 shows that on average, there was little or no difference in concentrations between the Simcoe control location and the two industry monitors. On an individual sample basis, there was an small observable effect when downwind of the steel mill, however, concentrations were well below criteria. The most notable downwind effect was that for benzene, however, average benzene levels were 50% lower in Nanticoke Village in 1995 than in 1993. The maximum benzene reading was 7.5 ug/m3 in 1995 compared to 17.0 ug/m3 in 1993. The coke oven control system probably caused this improvement.

TABLE 10
VOLATILE ORGANICS (VOC) - 1995

micrograms per cubic metre

By Env Canada

		22907 Nanticoke Village					22904 Walpole School					22071 Simcoe				
	24 HR GUIDELINE	No of Detects	Average 1995	Average 1994	Average 1993	Max 1995	No of Detects	Average 1995	Average 1994	Average 1993	Max 1995	No of Detects	Average 1995	Average 1994	Average 1993	Max 1995
VINYL CHLORIDE	1	0					0					7				0.1
1,3-BUTADIENE		1				0 1	4				0.1	25	0 0	0 0		0.1
ISOPRENE		10	0 1	0.1		0 2	6	0.1	0 1		0.2	36	0 1	0.1		0.9
1,1-DICHLOROETHENE	35	20	0.1	0.2		0 5	11	0 1	0 1		0 4	7			0 0	0.0
DICHLOROMETHANE ***	1765	27	1 7	2 0	1.0	7 7	25	1.3	5 0	0 6	3.8	57	0 6	0 6	0.7	11.7
1,1-DICHLOROETHANE		0					0					4				0.0
HEXANE	12000	27	0 5	0.5	0.6	1 1	25	0 6	0 4	0 8	1.4	55	0 4	0.5	0.7	1.9
TRICHLOROMETHANE	500	16	0 1	0.1	0 2	0 1	13	0 1	0 1	0 2	0.1	57	0 1	0 1	0 1	0 1
1,2-DICHLOROETHANE	400	0			0.1		0					56	0.0	0.0	0.1	0.1
CYCLOHEXANE	100000	18	0 1	0 1	0 1	0 3	19	0 1	0 1	0 1	0 4	43	0 4	0 1	0 1	18 6
CARBON TETRACHLORIDE	600	26	0.5	0.4	0.8	1 2	25	0 5	0 4	0 8	0 9	57	0 6	0.7	0.8	0.8
BENZENE		27	1 7	2 2	3 4	7 5	25	1 0	0 9	1 3	3 0	57	0 7	0 9	1 1	1 9
TRICHLOROETHYLENE	28000	13	0.1	0.1	0.1	0.2	10	0.1	0.1	0.1	0.2	47	0.1	0.1	0.1	0.2
1,1,1-TRICHLOROETHANE	115000	26	0.7	0.7		1 9	23	0 7	0 8		1 1	57	0 8	1 3		1 2
1,2-DICHLOROPROPANE	2400	0					0					2				0 0
TOLUENE	2000	27	1 3	1 2	1 6	3 7	25	1 4	0 9	1 3	3 0	57	2 7	1 5	1 7	81 2
1,1,2-TRICHLOROETHANE		0					0					2				0 0
1,2-DIBROMOETHANE		0					0									
TETRACHLOROETHYLENE	4000	24	0.1	0.1	0 1	0 3	21	0 1	0 1	0 1	0 3	56	0 1	0.1	0 2	0 2
CHLOROBENZENE		0					1				0 1	44	0 0	0 0		0 1
ETHYLBENZENE	4000	27	0 2	0 3	0 2	1 1	24	0 2	0 2	0 2	0 5	57	0 2	0 3	0 3	0 9
M-XYLENE	2300	27	0.8	0 9	0 6	2 7	25	0 7	0 5	0 6	1 6	57	0 6	0 6	0 7	2 6
STYRENE	400	5			0 1	0 1	1			0 1	0 1	41	0 0	0 1	0 1	0 1
O-XYLENE	2300	27	0 2	0 3	0 1	1 0	23	0 2	0 2	0 1	0 5	57	0 2	0 2	0 1	0 9
1,1,2,2-TETRACHLOROETHANE		0					0					22	0 0			0 1
a-PINENE		14	0 1	0 1		0 5	9	0 1	0 2		0 7					
1,3,5-TRIMETHYLBENZENE		8	0 1	0.1		0 2	9	0 1			0.2	56	0 1	0 1		0.4
1,2,4-TRIMETHYLBENZENE	1000	18	0 2	0 4	0 1	1 0	16	0 2	0 3	0 1	0 7	57	0 2	0 2	0 1	1 0
1,3-DICHLOROBENZENE		0					0					4		0 0		0.0
1,4-DICHLOROBENZENE		0					0					57	0 1	0 1		0 2
1,2-DICHLOROBENZENE	30500	0					0					3			0 0	0 0
NAPHTHALENE	22 5	17	0 5	1 1	0 8	1 9	8	0 1	0 3	0 4	0 4	57	0 2	0 2	0 4	0 7

*** *Dichloromethane data subject to occasional laboratory error*

Polynuclear Aromatic Hydrocarbons (PAH)

Similar to volatile organics, other semi-volatile compounds called polynuclear aromatic hydrocarbons (PAH) are a concern due to their potential toxic effects.

PAHs are a class of compounds which are the product of incomplete combustion of fuels. They are emitted from a variety of sources including coke ovens, woodstoves, motor vehicles and barbecues.. Several specific PAHs are carcinogenic including benzo(a)pyrene (BaP). A scan of 30 compounds are routinely analyzed, but only BaP has standards/guidelines, based on health effects.

Criteria for BaP are:

24 hour average - 1.1 ng/m3
1/2 hr average - 3.3 ng/m3

The smaller molecular weight PAHs exist in vapour form. The larger ones including BaP exist mostly adsorbed onto particles.

Specially outfitted high volume samplers collect PAH both on a filter and an adsorbent cartriidge which lies after the filter. The samplers run for 24 hour periods every 12th day.

Sampling began in 1994 at two stations - 22907 -Nanticoke Village near Stelco and at 22071- Simcoe which measured background. Data are summarized in Table 11.

Concentrations at Nanticoke Village were much higher on average than at Simcoe. The BaP objective was exceeded in 5 out of 27 samples in the Village and not at all at the Simcoe site. The Total PAH averages were 99 vs 15 ng/m3. There was a clear downwind effect of the steel mill in the Village samples.

Similar to benzene, PAH levels decreased substantially in 1995 in the Village. The average total PAH figure reduced from 187 to 99 ug/m3 and the BaP objective was exceeded in 5 of 27 samples (18%) compared to 8 of 15 (53%) in 1994.

The odour control system installed at the Stelco coke ovens lessened PAH emissions, but further abatement efforts may be required if the BaP objective is to be totally met.

TABLE 11
POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) - 1995

nanograms per cubic metre

		22907 - Nanticoke Village					22071 - Simcoe				
	24 Hour Objective	No of Detects	Average 1995	Average 1994	Max 1995	No. Times Over Obj.	No of Detects	Average 1995	Average 1994	Max 1995	No. Times Over Obj.
PAH TOTAL		27	99.2	186.7	428.4		25	15.2	25.7	34.3	
BIPHENYL		27	8.4	12.7	32.1		25	3.9	5.0	17.4	
ACENAPHTHYLENE		27	4.5	19.6	23.7		21	0.5	2.1	1.7	
ACENAPHTHENE		27	5.1	8.6	21.3		25	1.1	2.6	2.7	
FLUORENE		27	12.0	23.9	51.6		25	2.3	4.3	4.8	
PHENANTHRENE		24	19.0	46.3	111.0		25	4.4	6.7	9.4	
ANTHRACENE		20	1.6	4.9	10.4		1		0.3	0.3	
O-TERPHENYL		0					1			0.2	
1-METHYLPHENANTHRENE		26	1.5	2.1	8.2		21	0.3	0.4	0.6	
FLUORANTHENE		25	9.9	18.7	60.0		25	1.2	1.8	3.2	
PYRENE		27	8.1	12.7	44.8		25	0.6	1.1	1.6	
M-TERPHENYL		17	0.1	0.1	0.3		14	0.1	0.1	0.2	
P-TERPHENYL		0					0				
BENZO(A)FLUORENE		26	2.0	2.2	13.3		10	0.1	0.2	0.3	
BENZO(B)FLUORENE		22	2.4	2.6	16.1		4			0.4	
BENZO(A)ANTHRACENE		24	2.8	4.3	19.2		6	0.1	0.2	0.4	
CHRYSENE		26	4.7	5.4	27.7		12	0.2	0.4	0.6	
BENZO(B)FLUORANTHENE		26	6.2	6.1	39.5		14	0.3	0.3	1.0	
BENZO(K)FLUORANTHENE		19	2.2	2.4	14.1		2		0.2	0.4	
BENZO(E)PYRENE		19	1.2	3.3	6.8		4		0.2	0.2	
BENZO(A)PYRENE	1.1	22	1.4	3.4	11.4	5	7	0.1	0.2	0.3	0
PERYLENE		8	0.4	0.8	2.5		0				
INDENO(123CD)PYRENE		25	2.9	3.8	17.2		20	0.2	0.2	0.4	
DIBENZO(A,H)ANTHRACENE		19	0.8		5.0		5			0.2	
BENZO(GHI)PERYLENE		21	2.3	2.2	14.0		4		0.2	0.4	

DISCUSSION

Overall, 1995 data in the Nanticoke area revealed that air quality was very good and reflected a relatively minor impact by the main industries. Sulphurous odours near Stelco were one main item of concern. Control programs instituted by the company in 1995 effectively lowered emissions, but more work may be necessary.

Pollutants such as sulphur dioxide, oxides of nitrogen, fluorides and particulates showed quite low levels well within relevant objectives. Measurements of volatile organic compounds showed mostly low concentrations well within objectives near the steel mill and refinery, similar to that measured at a background control location. However, a small measurable effect was observed when downwind of the steel mill, particularly for benzene in Nanticoke Village. Concentrations of benzene were substantially lower in 1995 than in 1993/94, due largely to the installation of an odour control system on the coke ovens.

The coke oven control system was also effective in reducing polycyclic aromatic hydrocarbons (PAH) emissions. Concentrations were down by about 50% in Nanticoke Village, although objectives were still occasionally exceeded.

Sulphur dioxide (SO_2) normally recorded low measurements throughout the network of monitors. The Nanticoke Generating Station is the largest SO_2 source in the area but its effect on the Nanticoke area was fairly minor. Out of over 60,000 hours of monitoring, none exceeded the hourly objective. There have been no such exceedances measured since 1989.

Particulate levels in the region were quite low and showed mostly acceptable concentrations. However, dust emissions from the Stelco site might still occasionally be a problem. Efforts are being made to identify the source(s) of these emissions. Close to Ontario Hydro property, distinct improvements in both suspended particulates and dustfall readings have been measured and maintained for many years. A control program to control windblown flyash has been successful.

Another pollutant of major concern is ozone, a product of long range transport. Ozone again routinely exceeded objectives during the summer in Southern Ontario and appeared to arrive mostly from the United States. Levels measured at Long Point were among the highest recorded in the Province. Oxidant control will be required on an international and national rather than local scale. To this end, control programs in both the U.S. and Canada are being implemented to control volatile organic

compounds (VOC) and nitrogen oxides (NOx) in order to resolve the ground level ozone problem by the year 2005. The Nanticoke based industries will be required to participate in programs as they are developed. In fact, the industries have already begun some programs, e.g. NO_x control at Hydro and VOC control at Imperial Oil and Stelco.